

hemicellulose content ranging from about 5% by weight to about 27% by weight and more preferably from about 5% by weight to about 18%, most preferably from about 10 weight percent to about 15 weight percent. The average degree of polymerization of the cellulose preferably ranges from about 300 to about 1000, more preferably from about 300 to about 1100 and most preferably from about 400 to about 700. These fibers exhibit a copper number of less than about 2.0, more preferably less than about 1.1, and most preferably less than about 0.8.

Lyocell fibers of the present invention formed from dopes prepared from treated pulp of the present invention exhibit physical properties making them suitable for use in a number of woven and non-woven applications. Examples of woven applications include textiles, fabrics and the like. Non-woven applications include filtration media and absorbent products by way of example.

Additionally, the treated pulp of the present invention can be formed into films by means of techniques known to one of ordinary skill in the art. An example of a technique for making a film from the compositions of the present invention is set forth in U.S. Patent No. 5,401,447 to Matsui et al., and in U.S. Patent No. 5,277,857 to Nicholson.

The following examples merely illustrate the best mode now contemplated for practicing the invention, but should not be construed to limit the invention.

EXAMPLE 1

Southern pine unbleached alkaline Kraft pulp with a kappa number of 26.4 (TAPPI Standard T236 cm-85 and a viscosity of 302 cp (TAPPI T230) (D.P. of 1593), a copper number of 0.6 and a hemicellulose content of $13.5\% \pm 2.0\%$ was treated with oxygen in a pressure vessel with high consistency mixing capabilities. The mixture was stirred slowly for ten seconds every minute. The vessel had been preheated before pulp addition to about 90°C . An amount of sodium hydroxide (NaOH) equivalent to 100 pounds per ton of pulp was added to the alkaline pulp. The mixture was stirred for 20 seconds. The reaction vessel was then closed and the pressure was increased to 60 psig by introducing oxygen into the pressure vessel. The mixer was run for 60 minutes as described above. Water was present in the vessel in an amount sufficient to provide a 25% consistency.

After the 60 minutes, the stirring was stopped and the pulp was removed from the pressure vessel and washed. The resulting washed pulp viscosity was 46 cp (D.P. of 963). The treated pulp had a copper number of about 0.5 measured by TAPPI standard T430, a hemicellulose content of $13.5\text{ percent} \pm 2.0\%$, a kappa number of 10.6, and the ΔR for the treated pulp was 0.4.

EXAMPLE 2

The procedure of Example 1 was repeated with the addition of hydrogen peroxide after the addition of sodium hydroxide. The pressure vessel was run for 60 minutes at a temperature of 115°C . The peroxide was added in an amount of 20 pounds per ton of pulp.

The treated pulp had a viscosity of 30 cp (D.P. 810), a copper number of 0.3, and a hemicellulose content of $13.5 \pm 2.0\%$. The pulp exhibited a kappa number of 7.0.

EXAMPLE 3

The treated pulp of Example 1 was bleached to determine the effect of bleaching on the D.P. of the treated pulp. The treated pulp of Example 1 was subjected to a DED bleaching sequence comprising a chlorine dioxide D1 stage, a sodium hydroxide/hydrogen peroxide E stage and a chlorine dioxide D2 stage.

D1 STAGE

The D1 stage treated pulp processed in accordance with Example 1 by washing it three times with distilled water, pin fluffing the pulp, and then transferring the pulp to

a polypropylene bag. The consistency of the pulp in the polypropylene bag was adjusted to ten percent with the addition of water. Chlorine dioxide corresponding to an amount equivalent to 28 pounds per ton of pulp was introduced to the diluted pulp by dissolving the chlorine dioxide in the water used to adjust the consistency of the pulp in the bag. The bag was sealed and mixed and then held at 65° C for 15 minutes in a water bath. The pulp was removed and washed with deionized water.

E STAGE

The washed pulp was then placed in a fresh polypropylene bag and caustic was introduced with one-half of the amount of water necessary to provide a consistency of ten percent. Hydrogen peroxide was mixed with the other one-half of the dilution water and added to the bag. The hydrogen peroxide charge was equivalent to 20 pounds per ton of pulp. The bag was sealed and mixed and held for one hour at 88°C in a water bath. After removing the pulp from the bag and washing it with water, the mat was filtered and then placed back into the polypropylene bag and broken up by hand.

D2 STAGE

Chlorine dioxide was introduced to the pulp in an amount equivalent to 20 pounds per ton of pulp with the dilution water necessary to provide a consistency of 10 percent. The bag was sealed and mixed, and then held for three hours at 80°C in a water bath.

The resulting pulp was removed from the bag and dried. The bleached pulp had a pulp viscosity of about 40 cp (D.P. of 914), a TAPPI brightness of 88, a copper number of 0.6, a ΔR of 1.4 and a hemicellulose content of 13.0%. The kappa number of the pulp prior to the D₁ stage was 10.6.

EXAMPLE 4

This example treats a pulp of Example 2 with the bleaching sequence of Example 3. The resulting pulp exhibited a viscosity of about 22 cp (D.P. of 697), a TAPPI brightness of 88.3, a copper number of 0.6, a ΔR of 2.0, and a hemicellulose content of 13.0%. The kappa number of the pulp prior to the D₁ stage was 7.0.

EXAMPLE 5

Southern pine unbleached alkaline pulp was treated by the process described in Example 1 with unoxidized Kraft white liquor being used as caustic in place of sodium